Direct Numerical Simulations of non-Newtonian jets: Understanding the physical mechanisms

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Abstract

While both several experimental and numerical studies for Newtonian sprays have been conducted, the exploration of the non-Newtonian flows has received comparatively little attention. Achieving fundamental understanding of the physical phenomena governing spray formation of this type of flow remains a challenge. The present project aims to set the basis for the numerical examination of non-Newtonian atomisation and spray systems. To achieve this, a Direct Numerical Simulations (DNS) approach is followed where all the temporal and spatial scales are completely resolved. We explore the dynamics of a power-law spray within a two-dimensional/axisymmetric framework, which permits rapid exploration of parameter space. This will serve as a departure point for further work involving three-dimensional simulations, and constitutive models associated with more complex rheology, which will offer substantial challenges but is reflective of industrial applications.

Keywords: Atomisation, DNS, non, Newtonian, liquid jet

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